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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/833,260 | 04/10/2001 | Hans-Jurgen Hacke | GR 00 P 1708 | 2776 |

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[REDACTED] EXAMINER

PAREKH, NITIN

| ART UNIT | PAPER NUMBER |
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| 2811 | 14 |

DATE MAILED: 01/16/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

| | | |
|--|-------------------------------|------------------------------------|
| | Application No. 09/833,260 | Applicant(s) HACKE, HANS-JURGEN |
| | Examiner Nitin Parekh | Art Unit 2811 |

-- The MAILING DATE of this communication appears on the cover sheet with the corresponding address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 18 November 2002.
- 2a) This action is FINAL. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 52-104 is/are pending in the application.
- 4a) Of the above claim(s) 78-104 is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 52-77 is/are rejected.
- 7) Claim(s) _____ is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) The proposed drawing correction filed on _____ is: a) approved b) disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) All b) Some * c) None of:
1. Certified copies of the priority documents have been received.
2. Certified copies of the priority documents have been received in Application No. _____.
3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) The translation of the foreign language provisional application has been received.
- 15) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) 9 . | 6) <input type="checkbox"/> Other: |

Claim Objections

1. Claim 52 is objected to because of the following informalities:

Claim 52, line 9 cites: Delete "... said contact area extending from" and insert ----"... said contact element extending from... "----.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 59 and 61 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 59, line 2 cites: "...wherein said surface of the said substrate has a largest bulging and the contact element has a length that is at least 5% greater than said largest bulging of said surface of said substrate."

It is not clear from the description in the specification or Figures that in reference to "the largest bulging of the substrate surface", what are the conditions and parameters

that the largest bulging of the substrate surface is achieved so that a dimensional comparison can be made with respect the length of the contact element as claimed.

Furthermore, it is not clear if the largest bulging of the surface is in referenced with respect to length, width or the area of the substrate surface.

Claim 61, lines 3- 6 cites: ".....said contact element having a length being at least 5% greater than the largest length difference with regard to said centrally located neutral point of the substrate in event of maximum thermal cycling".

It is not clear from the description in the specification what conditions and parameters are referred to define "maximum thermal cycling" so that a dimensional comparison can be made with respect the length for the claimed elements.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 52-58, 60, 63 and 64 are rejected under 35 U.S.C. 102(b) as being anticipated by Loro (US Pat. 3825353).

Regarding claim 52, Loro discloses a semiconductor/electronic device comprising:

- a substrate/wafer/chip (1 in Fig. 1-4D) having a surface
- an electronic circuit having interconnects (9 in Fig. 3) formed on the surface of the substrate
- the circuit including a plurality of contact areas (not numerically referenced – areas under beam lead 2/4/5 in Fig. 1 and 3, see metallization/interconnect area under anchor 13 and arm 5 of the beam lead in Fig. 4D)
- the contact areas including contact elements (2/4/5 in Fig. 2) that is integrally connected to the contact areas in one piece, the contact element extending from the contact area (Fig. 2) in three dimensions

(Fig. 1-5H; Col. 3, line 45- Col. 6, line 40).

Loro further discloses the contact areas and contact elements having microscopically small dimensions ranging from 24-110 microns (Col. 8, line 47).

Regarding claim 53, Loro further discloses the contact area/element of the device being configured opposite the connection area of an intermediate carrier/substrate (7 in Fig. 2) having a flat conductor/pad (6 in Fig. 2).

Regarding claim 54, as explained above for claim 52, Loro discloses the substrate being a semiconductor wafer or chip having an electronic circuit on/near the surface of the substrate.

Regarding claim 55, Loro further discloses a plurality of interconnects having ends and each of the contact areas/elements being configured on the respective ends of each of the interconnects (Fig. 3 and 5D).

Regarding claim 56, Loro further discloses the contact elements being elastically deformable/flexible (Col. 1, line 55; Col. 9, line 25-50).

Regarding claim 57, Loro further discloses the contact elements being formed/preformed at an angle that is smaller than an orthogonal angle from the substrate surface and being deviated from a direction orthogonal to the substrate surface (2/4/5 in Fig. 1-3).

Regarding claim 58, Loro further discloses the contact elements being formed being bent at an angle that deviated from a direction orthogonal to the substrate surface (2/4/5 in Fig. 1-3).

Regarding claim 60, as explained above for claims 52 and 53, Loro further discloses the contact element having a length being 5% greater than the largest distance between the contact areas of the device and intermediate carrier (Fig. 2).

Regarding claim 63, Loro further discloses the conventional use of same metal/alloy as gold for the contact element and the contact area to improve the reliability (Col. 2, line 30).

Regarding claim 64, Loro further discloses using the alloys comprising aluminum for the contact area and gold, nickel/gold coating, etc. for the contact element (Fig. 5A-H; Col. 7, line 62- Col. 8, line 22; Col. 6-9).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 61 and 62 are rejected under 35 U.S.C. 103(a) as being unpatentable over Loro (US Pat. 3825353).

Regarding claim 61, Loro discloses the contact elements having different length, width, etc. (Fig. 1-5H) but fails to specify the contact element having a length being at least 5%

greater than the largest length difference with regard to a centrally located neutral point (CNP) of the substrate in event of maximum thermal cycling.

However, the determination of parameters such as dimensions (length, width, etc.) of the contact element/lead, contact area/pad (shape, cross-section, etc.) interconnect wiring//trace, number of contact elements/leads, pitch/spacing, etc. and their effect/interaction due to thermal processing, thermal cycling, differences in thermal expansion of various material, etc. in chip packaging and interconnection technology art is a subject of routine experimentation and optimization to achieve the desired interconnect reliability, bonding strength and yield.

Therefore, it would have been obvious to a person of ordinary skill in the art at the time invention was made to select the contact element having a length being at least 5% greater than the largest length difference with regard to a centrally located neutral point (CNP) of the substrate in event of maximum thermal cycling so that interconnect reliability and the bonding strength can be improved in Loro's device .

Regarding claim 62, as explained above for claims 52, 60 and 61, Loro teaches the contact element having a length being at least 5% greater than the largest length difference between the substrate and the intermediate carrier relative to the centrally located neutral point (CNP) of the substrate in event of maximum thermal cycling.

6. Claims 65-77 are rejected under 35 U.S.C. 103(a) as being unpatentable over Loro (US Pat. 3825353) in view of Mallik et al (US Pat. 5420461), Grube et al (US Pat. 5525545) and Khandros et al (US Pat. 5917707).

Regarding claim 65, Loro fails to specify using the contact element being produced from a copper alloy.

Mallik et al teach using contact elements/leads having top/head and bottom/base portions (20 in Fig. 1), the contact elements/leads being produced from a copper/gold alloy to reduce thermal stress and fatigue (Col. 2, line 62; Col. 2-4). Mallik et al further teach having contact elements/leads (34 in Fig. 1) having a solder/metal alloy coating to provide reflow capability (Col. 4, line 1-3).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the contact element being produced from a copper alloy so that the thermal stress can be reduced and bonding strength can be improved using Mallik et al's contact structure in Loro's device.

Regarding claim 66, Loro fails to specify the contact element being designed as a contact pin.

However, Loro further discloses the contact element having a shape of a pin having an anchor and a head (25 and 5 respectively in Fig. 5G/H) where the head is remote from the contact area.

Mallik et al teach conventional pins being used as contact elements/leads (Col. 3, line 33).

Khandros et al teach using a pin having a head at an end (112/106 in Fig. 1) for a contact element in a conventional contact structure where the head is remote from the contact /pad area (103 in Fig. 1; Col. 1-4).

Grube et al teach using a variety of shapes and forms of contact elements comprising spring/leaf, coil, etc. having tapered free ends/fingers (245 in Fig. 6/7) to achieve the desired contact area and reliability for the interconnection (Fig. 6, 7, 10-12, etc. Col. 20, line 20).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the contact element being designed as a contact pin so that the rigidity of the interconnection can be improved and the desired contact area can be achieved using Mallik et al, Khandros et al and Grube et al's contact structures in Loro's device.

Regarding claim 67, as explained above for claim 66, Loro in view of Mallik et al, Khandros et al and Grube et al to specify the contact pin having a diameter being not greater than half of the shortest linear dimension of the contact area.

However, as explained above, the determination of parameters such as dimensions of the contact element/lead including a diameter/length, contact area/pad, interconnect wiring//trace, number of contact elements/leads, pitch/spacing, etc. and their effect/interaction due to thermal processing, thermal cycling, differences in thermal

expansion of various material, etc. in chip packaging and interconnection technology art is a subject of routine experimentation and optimization to achieve the desired interconnect reliability, bonding strength and yield.

Therefore, it would have been obvious to a person of ordinary skill in the art at the time invention was made to select the contact pin having a diameter being not greater than half of the shortest linear dimension of the contact area so that interconnect reliability and the bonding strength can be improved using Mallik et al, Khandros et al and Grube et al's structures in Loro's device.

Regarding claim 68, as explained above for claims 52, 61 and 66, Loro in view of Mallik et al, Khandros et al and Grube et al teaches the contact element being designed as a contact pin having an end with a contact head, the end being remote from the contact area.

Regarding claim 69, as explained above for claims 52, 64 and 68, Loro in view of Mallik et al, Khandros et al and Grube et al teaches using the contact pin having an end being coated with a coating selected from a group consisting of a nickel and gold coating.

Regarding claim 70, as explained above for claims 52, 65 and 68, Loro in view of Mallik et al, Khandros et al and Grube et al teaches using a coating made of a solderable metal alloy.

Regarding claim 71, as explained above for claims 52, 65 and 68, Loro in view of Mallik et al, Khandros et al and Grube et al teaches using a contact pin having a head being made from a solder.

Regarding claim 72, as explained above for claims 52 and 66, Loro in view of Mallik et al, Khandros et al and Grube et al teaches using a contact element being designed as a contact spring.

Regarding claim 73, as explained above for claims 52, 66 and 72, Loro in view of Mallik et al, Khandros et al and Grube et al teaches using a contact element being designed as a contact spring, the contact spring being a contact leaf having an end being connected to the contact area.

Regarding claim 74, as explained above for claims 52, 61, 66 and 70-72, Loro in view of Mallik et al, Khandros et al and Grube et al teaches selecting the dimensions/width of the contact area and contact element/leaf spring such that they correspond to each other.

Regarding claim 75, as explained above for claims 52, 61, 66 and 70-74, Loro in view of Mallik et al, Khandros et al and Grube et al teaches selecting a leaf spring having a square cross-section having a tapered free end.

Regarding claim 76, as explained above for claims 52, 57 and 66, Loro in view of Mallik et al, Khandros et al and Grube et al teaches using a contact spring extending three-dimensionally at an angle smaller than an orthogonal angle from the contact area.

Regarding claim 77, as explained above for claims 52, 69, 72 and 73, Loro in view of Mallik et al, Khandros et al and Grube et al teaches using a contact spring having a free end, the free end being provided with a coating selected from a group consisting of a nickel and gold coating.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nitin Parekh whose telephone number is 703-305-3410. The examiner can normally be reached on 09:00AM-05:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722, 703-308-7724 or 703-872-9318 (Right FAX) for regular communications; 703-872-9310 (Right FAX) for After Final communications and 703-872-9310 (Right FAX) for customer service.

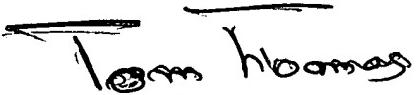
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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-306-3431.

Nitin Parekh

NP
01-11-03


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